

## WHAT IS CLAIMED IS:

1. A quadrature modulator comprising a local oscillator for oscillating at an oscillation frequency equal to  $4/(2N+1)$  times a carrier frequency where  $N$  is a natural number, a frequency conversion block for multiplying  
5 said oscillation frequency by a factor of  $(2N+1)/2$ , a first frequency divider to divide an output from said frequency conversion block by a factor of two to output a pair of carrier waves having therebetween a phase difference of 90 degrees, first and second multipliers for modulating  
said carrier waves with a digital baseband signal to output a pair of modulated signals, and an adder for adding said modulated signals together to output a digital carrier signal having said carrier frequency.

2. The quadrature modulator as defined in claim 1, wherein said  $N$  is equal to "1", and said frequency conversion block includes a second frequency divider for dividing said oscillation frequency by a factor of two to  
5 generate a divided frequency, a frequency mixer for mixing outputs from said local oscillator and said frequency divider to generate a first signal having a frequency equal to a sum of said oscillation frequency and said divided frequency.

3. The quadrature modulator as defined in claim 2, wherein said frequency conversion block further includes a band-pass-filter (BPF) for removing an image signal from said first signal.

4. The quadrature modulator as defined in claim 2, wherein said frequency mixer is a double-balanced mixer.

5. The quadrature modulator as defined in claim 1, wherein said N is equal to or more than "2", and said frequency conversion block includes a second frequency divider for dividing said oscillation frequency by a factor of two to output a divided frequency, N frequency mixers cascaded from one another for mixing said oscillation frequency and said divided frequency or an output from a preceding one of said frequency mixers to output a first signal having a frequency equal to a sum of said oscillation frequency and said divided frequency or a frequency of another first signal output from said preceding one of said frequency mixers.

6. The quadrature modulator as defined in claim 5, wherein said frequency conversion block further includes a BPF cascaded from an N-th one of said frequency

mixers to remove an image signal from said first signal  
5 from said N-th one of said frequency mixers.

7. The quadrature modulator as defined in claim 5,  
wherein each of said frequency mixers is a double-  
balanced mixer.

8. A method comprising the steps of generating a  
oscillation frequency equal to  $4/(2N+1)$  times a carrier  
frequency where N is a natural number, multiplying said  
oscillation frequency by a factor of  $(2N+1)/2$ , dividing  
5 said multiplied oscillation frequency by a factor of two to  
generate a pair of orthogonal carrier waves having said  
carrier frequency, modulating said orthogonal carrier  
waves with a digital baseband signal to output a carrier  
signal having said carrier frequency.